

On *Pseudopythina rugifera* (CARPENTER, 1864) (Bivalvia)

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(9 Text figures)

INTRODUCTION

LITTLE IS KNOWN of the structure, functions of the organs in the mantle cavity, and the adaptations found in the Leptonacea, composed largely of commensal species, in correlation with their specialized mode of life.

POPHAM (1940, p. 549) refers to the biology of some species belonging to the genera *Kellia*, *Lasaea*, *Montacuta*, *Mysella*, *Devonia* and *Galeomma*. *Ceratobornia cema* (= *Lepton cema* NARCHI, 1966) was intensively studied. Other genera were studied but no references were found for *Pseudopythina*.

Pseudopythina rugifera (CARPENTER, 1864) occurs on the Pacific Coast of North America from Alaska to Lower California (ABBOTT, 1954, p. 395; PALMER, 1958, p. 90). According to KEEN (1937, p. 25) it ranges from 37° to 48° North Latitude. The species is well known in the eastern Pacific as an "ectoparasite" of the crustacean *Upogebia pugettensis* (DANA, 1852) and could be found attached by its byssus to the ventral surface of the polychaete worm, *Aphrodita* (OLDROYD, 1924, p. 136; MACGINITIE & MACGINITIE, 1949, p. 348; PALMER, *loc. cit.*; BOSS, 1965, p. 186). OLDROYD (*loc. cit.*) states that all species of the genus *Pseudopythina* FISCHER, 1884, are commensals. In this paper observations on the structure, ciliary currents of feeding and digestion, and some other functional adaptations of *P. rugifera* are studied.

The animals were found attached to the broad annulated foot of *Aphrodita refulgida* MOORE, collected at Tomales and at Bodega Bay, Marin County, California (Figure 1). Several specimens were examined alive and the ciliary currents in the mantle cavity were observed with use of carmine, aquadag, and powdered carborundum. Others were fixed in Bouin's fluid. Serial sections of 6 μ were made and the sections stained in Delafield's hematoxylin, eosin and Alcian blue, to examine the general anatomy. The observations on living specimens were made at the Pacific Marine Station, Dillon Beach, California.

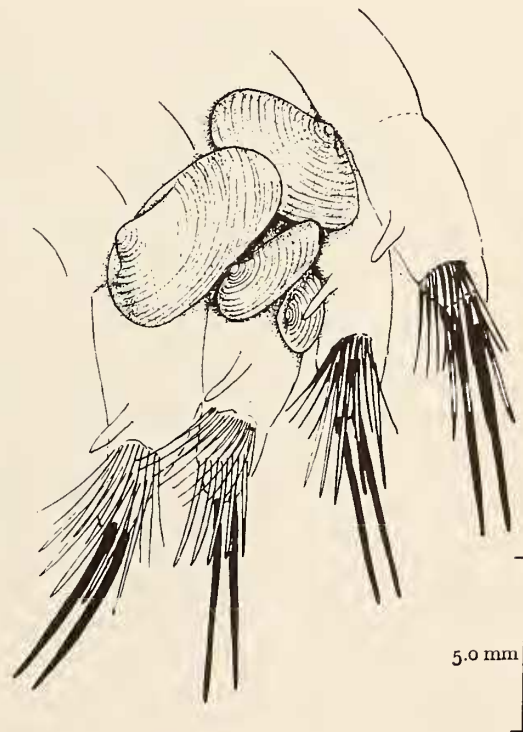


Figure 1

General view of several specimens of *Pseudopythina rugifera* attached to *Aphrodita*

SHELL AND MANTLE

The shell is small, oval-oblong, moderately obese and fragile, reflecting the protected habitat of this species. The umbones are close together, and located near the middle line of the shell. Lateral teeth are absent and one large central tooth (Figure 2) exists on each valve (CARPEN-



Figure 2

View of the hinge of *Pseudopythina rugifera* (× 40)

TER, cited by PALMER, 1958, p. 90). The shell is covered with a thin, light brown periostracum which is concentrically wrinkled. The embryonic shell is still visible in the adult near the umbo. Foraminifera were found frequently attached to the shell. The shell of the largest animal encountered in this study measured 6 mm in length, 2.5 mm in height, and 1.5 mm in width.

The species possesses both an external and an internal ligament, the latter being much more developed. As in *Kellia suborbicularis* (MONTAGU, 1803), the shell and the fleshy parts of *Pseudopythina rugifera* are white in color (OLDFIELD, 1961, p. 257). In living animals the foot protrudes from the shell to a distance equal to half the length of the shell. The mantle edges, the inhalant and exhalant siphons do not extend beyond the shell valves as in *Montacuta substriata* (POPHAM, 1964, p. 564).

As in *Montacuta ferruginosa* and *M. substriata* (OLDFIELD, 1961, p. 260), there are only two pallial openings: a large, inhalant and pedal aperture in the anterior and ventral part of the body, and a small exhalant aperture posteriorly located. The inner mantle folds are fused between these two apertures in a very short extension.

The exhalant siphon is shorter and formed by the inner mantle folds. The edges of this siphon bear small papillae of which one dorsal and one ventral papilla are slightly larger and can be seen protruding out of the shell.

The mantle edge has three folds. The outer fold is enclosed by the periostracum and has a flattened epithelium. The middle fold bears few papillae and secretes the periostracum. The inner fold contains the circum-pallial nerve. The folds are very similar to those of *Kellia suborbicularis* (OLDFIELD, 1961, p. 260). In the dorsal part of the inner mantle fold, from the region of the stomach up to the pallial fusion, a tract of strongly ciliated cells occurs. This tract is concerned with the rejection of particles from the mantle. The free edge of the mantle surrounding the inhalant siphon and pedal opening is also ciliated. Particles falling on this edge are passed into the mantle cavity.

THE CTENIDIA

Both demibranchs are present in *Pseudopythina rugifera* (Figure 3), but the outer demibranch (od) is less than half the depth of the inner (id). Only the inner demibranch has a food groove along its ventral edge. Lamellae are flat and homorhabdic, as found in the Leptoniidae (ATKINS, 1937, p. 391). Behind the foot (f), the left and right inner demibranchs are joined together in the median plane. As in *Kellia suborbicularis* (OLDFIELD, 1961, p. 263), both outer and inner demibranchs on each side are fused ventrally to the mantle, in the region where the fused inner folds of the mantle separate the common inhalant and pedal aperture from the exhalant aperture.

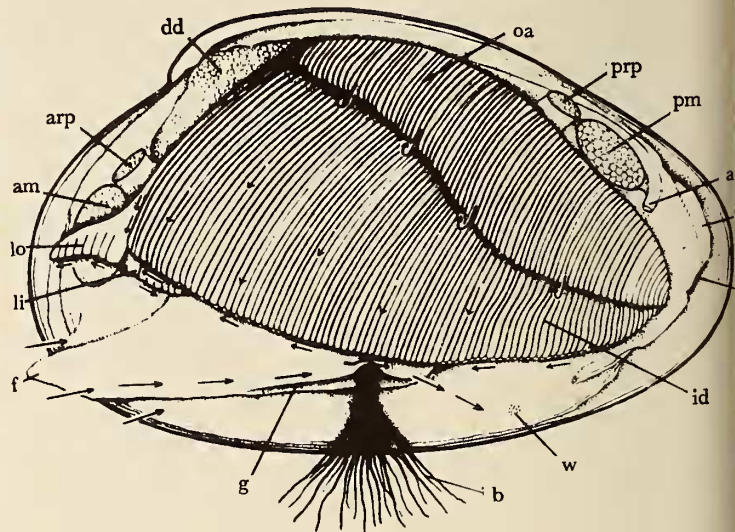


Figure 3

Pseudopythina rugifera (CARPENTER, 1864)

Mantle cavity viewed from the left side after removal of the left shell valve and mantle lobe, showing ciliary currents.

a - anus am - anterior adductor muscle b - byssus
arp - anterior retractor pedis muscle dd - digestive diverticula
exs - exhalant siphon f - foot g - foot groove
id - descending lamella of inner demibranch li - inner labial palp
lo - outer labial palp oa - ascending lamella of outer demibranch
prp - posterior retractor pedis muscle w - waste material
pm - posterior adductor muscle te - tentacle

The gill filaments are numerous. Slender interfilamentar junctions are numerous but interlamellar junctions are few. This condition is found in other species where the incubatory habit occurs (OLDFIELD, 1961, p. 263).

The ciliary mechanism in the ctenidia of *Pseudopythina rugifera* is similar to that of *Kellia suborbicularis* (AT-

KINS, 1937, p. 389). The ctenidia and their ciliation are as in Type C(1) of ATKINS (*loc. cit.*).

There is no interruption of the latero-frontal cilia at the ventral tip of the filaments of the ctenidia, but rather a bending of the filaments. The frontal currents on the outer demibranch are directed ventrally on the ascending lamella, bend at the free edge and flow dorsally on the descending lamella. The frontal cilia are not modified. In the free edge of the outer demibranch no longitudinal currents occur.

The frontal currents on the inner demibranch are directed ventrally on the ascending and descending lamellae. In the free edge of the inner demibranch an oral longitudinal current occurs. Other oral currents occur between the bases of the two demibranchs of each side of the body.

Along the marginal grooves of the inner demibranch shorter guarding cilia exist. On each ventral tip of the filaments these cilia beat as a group, moving particles to the anterior part of the body.

The fine frontal cilia are continued on each side and beat directly to the ventral part.

The long lateral cilia form an inhalant current and the frontal cilia convey food particles along the filament to the food groove.

There is one type of latero-frontal cilia: the eu-latero-frontal cilia which are fused, large, and prevent the loss of food particles into the supra branchial chamber.

As in *Kellia suborbicularis* (OLDFIELD, 1961, p. 264), guarding cilia exist on both sides of the food groove and these cilia prevent the entrance of coarse particles into the groove. ATKINS (1937, p. 360) suggests that guarding cilia occur when the animals live in a silt or muddy substrate.

MUSCULATURE

The anterior adductor muscle (Figure 4, am) is slightly larger than the posterior adductor muscle (pm). The rejected material is violently shot out of the pallial cavity by a sudden contraction of the adductors.

POPHAM (1940, p. 564) describes the same phenomenon for *Kellia suborbicularis*. OLDFIELD (1961, p. 264) believes

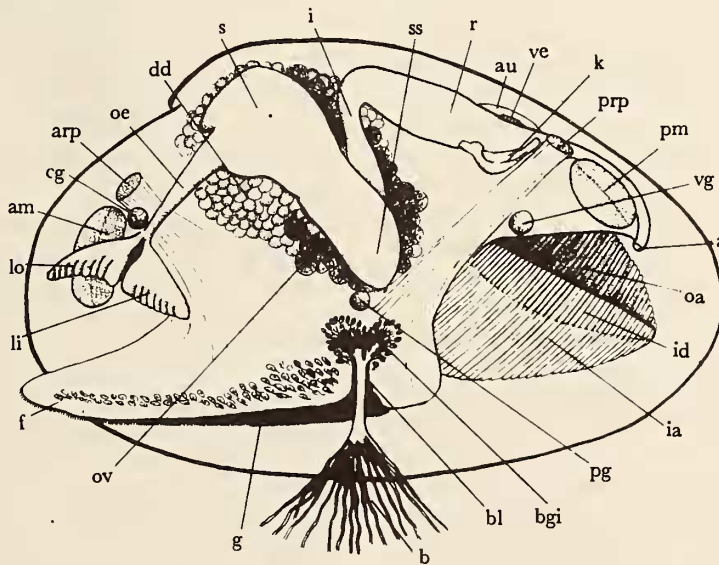


Figure 4

Pseudopythina rugifera (CARPENTER, 1864)

Diagrammatic representation of the organs in the mantle cavity

- | | | | |
|--|-------------------------|---|--|
| am - anterior adductor muscle | au - auricle | id - descending lamella of inner demibranch | k - kidney |
| arp - anterior retractor pedis muscle | bgi - main byssus gland | li - inner labial palp | lo - outer labial palp |
| bl - byssogenous lamella | cg - cerebral ganglion | oa - ascending lamella of outer demibranch | ov - ovary |
| dd - digestive diverticula | f - foot | pg - pedal ganglion | oe - oesophagus |
| i - intestine | g - foot groove | pm - posterior adductor muscle | prp - posterior retractor pedis muscle |
| ia - ascending lamella of inner demibranch | ss - style sac | ve - ventricle | r - rectum |
| | | | s - stomach |
| | | | vg - ventral ganglion |

that this is probably essential in species which live in a sandy or muddy habitat and prevents the danger of their silting up. Each adductor muscle is subdivided equally into two parts, as in *Kellia* and *Montacuta*.

There are two pairs of muscles of the foot: a pair of anterior retractor pedis muscles (arp) and a pair of posterior retractor pedis muscles (prp).

As in *Kellia* and *Montacuta*, there is no elevator pedis muscle. The anterior retractor pedis muscle is completely subdivided into a smaller retractor pedis muscle and a larger byssus retractor muscle. As in *Montacuta substriata* (OLDFIELD, 1961, p. 267) the well developed byssus musculature is related to the high development of the byssus apparatus in this species. In *Pseudopythina rugifera* the protractor pedis muscle runs through the lower part of the anterior retractor pedis muscle, but is inserted together with the byssus retractor muscle (br), while in *M. substriata* they have a separate origin from the shell (OLDFIELD, 1961, p. 267).

THE FOOT

The foot is large and though laterally compressed, has a flat creeping sole by means of which it is capable of active locomotion. It is slender and, when fully distended, is half the length of the shell, but it can be completely withdrawn when the shell valves are closed. The large pedal aperture combined with the inhalant aperture permits the foot to move in a wide angle. As in *Montacuta substriata* (POPHAM, 1940, p. 565), rocking movements are possible because of the gape and the large size of the pedal opening. The byssus cavity (bg) lies posteriorly in the foot and opens by way of a byssus canal into a groove (g) which extends on the ventral side almost to the tip of the foot. In *M. substriata* (POPHAM, *loc. cit.*) two or three threads are produced but in *Pythina rugifera* the number is greater.

The ventral and ventro-lateral surfaces of the foot are covered by a ciliated columnar epithelium, as are the surface of the byssogenous lamellae (bl), the byssus canal and groove.

The viscera do not extend into the foot. In the foot there are many muscle fibers and connective tissue with large blood spaces.

Pseudopythina rugifera lives attached to the foot of the sea mouse by a large byssus (b) composed of a large number of threads. The byssus cavity is embedded in the main byssus gland and is divided by a fold into two large longitudinal parts (Figure 5). Each part is divided into 10 to 12 slit-like compartments by the byssogenous lamellae. Each lamella is composed of connective tissue and

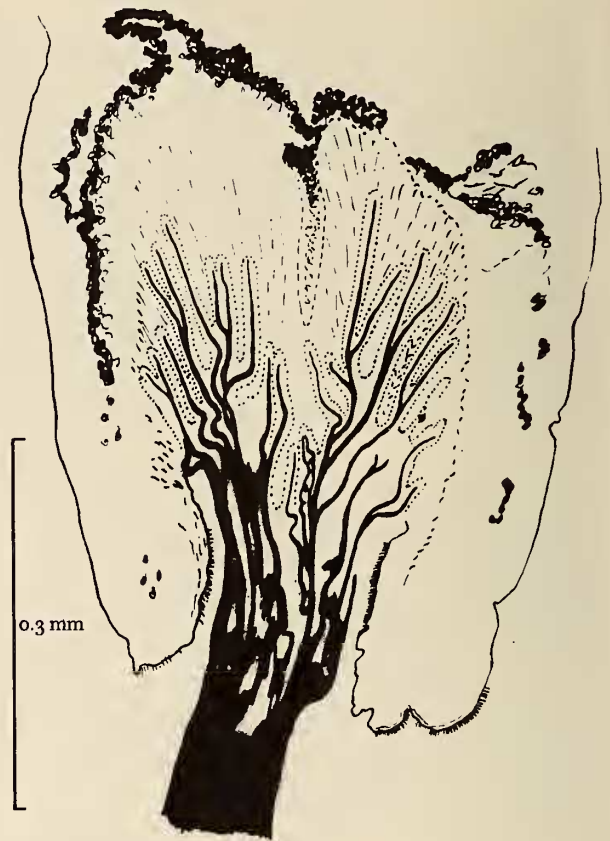


Figure 5

Pseudopythina rugifera (CARPENTER, 1864)
Byssus gland and byssus thread

fine muscle fibers from the byssus retractor muscle. A ciliated columnar epithelium covers the lamellae and is composed of low columnar cells. The byssus apparatus of *P. rugifera* is very similar to that found in *Potidoma subtrigonum* (DEROUX, 1961, p. 119).

The glandular cells of the main byssus gland (bgi) surround the byssus cavity. From these cells, in which the cytoplasm laden with fine granules, stains in aniline blue, long slender ducts lead to openings between the ciliated epithelial cells covering the surfaces of the byssogenous lamellae, in the byssus cavity. Thus the secretion of the main byssus gland forms a coating to the lamellae, and these sheets of secretion coalesce to form the stalk of the byssus.

The byssus canal is ciliated on its anterior and lateral walls and the byssus groove is ciliated throughout its entire length.

The main mucus gland occupies the anterior part of the foot and extends along both sides to the posterior end of the foot. From these mucus cells slender ducts open on the byssus groove on the ventral and ventro-lateral surfaces of the foot.

The construction of the byssus threads by adult animals was observed in the laboratory. A new byssus thread is constructed in 30 seconds and this velocity is probably due to the habits of the animal. To build a new byssus thread the foot is placed on the sole of the sea mouse. It becomes temporarily attached, apparently by a sucker-like action, and does not move. Only the tip of the foot moves laterally back and forth, until the byssus thread is completed.

Pseudopythina rugifera, detached from the sole of *Aphrodita*, with very active locomotion attached itself to the ventral part of the animal in a few seconds. As in *Montacuta substriata* (POPHAM, 1940, p. 566), the surface of the foot is strongly ciliated. Particles move rapidly across the sides of the foot from the tip to the heel and are passed off into the main rejection current concerned with the rejection of waste material, which passes out between the shell valves in a posterior and ventral direction immediately behind the foot.

LABIAL PALPS

The labial palps are relatively small; their opposed surfaces are covered by cilia and they have 9 transverse ridges. The ridged and grooved surfaces function as a sorting region. Particles of food and other material are swept onto the palps from the food groove of the inner demibranch. On the crests of the folds, particles are carried forward from fold to fold towards the mouth. On the floor of the grooves, between adjacent folds, particles are driven to the ventral border of the palp and from there moved to the tip of the palp where they are rejected.

The ventral tips of the anterior filaments of the inner demibranch are not inserted into a distal oral groove, although the antero-ventral margin of the inner margin of the inner demibranch is fused to the inner palp lamella and belong to the Category III of the association of ctenidia and labial palps (STASEK, 1963, p. 91).

THE ALIMENTARY CANAL

GENERAL STRUCTURE

The small size of the specimens made it difficult to study and observe the internal structure of the stomach in great detail. The alimentary canal was dissected in

specimens that had been preserved in alcohol. The internal structure of the stomach was studied in living specimens. The stomach was opened from the surface by a mid-dorsal incision through the roof, and the right side of the stomach was drawn downwards. The ciliary currents were determined with the aid of carmine, aquadag and fine carborundum particles. The nomenclature used by GRAHAM (1949), OWEN (1953), PURCHON (1955), and REID (1965) has been followed.

The mouth opens into the oesophagus (oe) which joins the stomach (s) at the anterior and ventral part, which is thin-walled and globular. The stomach is approximately cylindrical in shape and is surrounded by the digestive diverticula (dd).

The combined style-sac (ss) and intestine open into the posterior and ventral region of the stomach; the style-sac and intestine intercommunicate by an opening. This opening was observed in *Montacuta* by PELSENER (cited by OLDFIELD, 1961, p. 273) but it was not seen by her in the same genus. The style-sac and intestine are joined in a short extension; after this, the intestine leaves the style-sac on the right side. The intestine (i), after a small loop, ascends dorsally and then continues as a very well developed rectum (r). The rectum passes over the posterior adductor muscle and finally opens into the anus (a) close to the exhalant aperture.

STRUCTURE OF THE STOMACH

Pseudopythina rugifera has a stomach of type 4 (Figure 6), as defined by PURCHON (1958, p. 488). The minor typhlosole is absent in this species. PURCHON (*op. cit.*, p. 489) states that the minor typhlosole appears to be absent in the Anomiidae, Erycinidae and Montacutidae. The major typhlosole (ty) projects into the stomach, passes forwards from the aperture of the mid-gut and curves gradually to the left over the floor of the stomach. The major typhlosole is accompanied on its right side by the intestinal groove (ig).

A sorting area consisting of a small number of folds and grooves is present on the anterior face of the stomach between the orifice of the oesophagus (oe) and the intestinal groove. This sorting area extends on to the left anterior wall of the stomach, invades the left pouch (lp) and ends close to the terminal region of the major typhlosole.

The intestinal groove is enveloped by the sorting area.

There is a relatively small dorsal hood (dh), the aperture of which is penetrated by a lobe of the gastric shield (Figure 7, gs). The dorsal hood lies on the left anterior

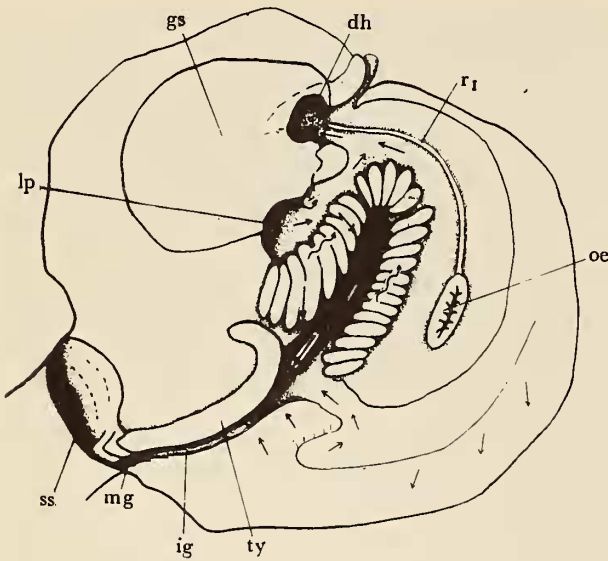


Figure 6

Pseudopythina rugifera (CARPENTER, 1864)

Interior of the stomach, seen from the right side, after an incision through its right side extending into the style sac

- dh - dorsal hood gs - gastric shield ig - intestinal groove
- lp - left pouch mg - midgut r₁ - ciliated ridge
- oe - oesophagus ss - style sac ty - major typhlosole

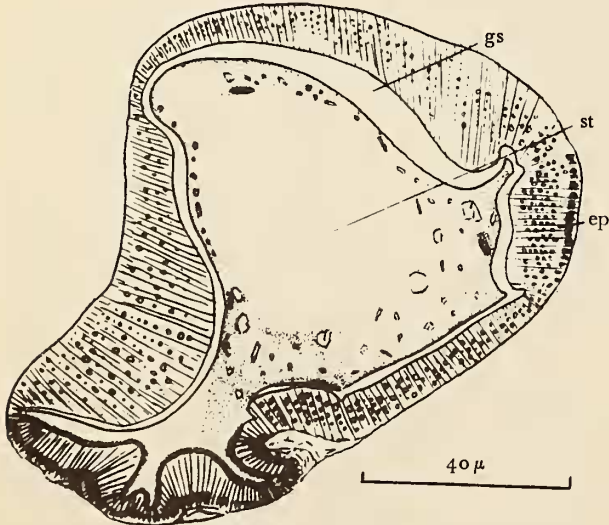


Figure 7

Pseudopythina rugifera (CARPENTER, 1864)

Transverse section of the stomach

- ep - epithelium gs - gastric shield st - style

stomach wall, as in *Scintilla hanleyi* (PURCHON, 1958, p. 498).

The epithelium of the stomach underlying the gastric shield consists of tall narrow columnar cells each with an oval nucleus near the base of the cell (Figure 8). The distal region is packed with almost spherical granules up to 4 μ in diameter. Similar spherical granules were found in cells of the stomach of Nuculidae (OWEN, 1953, p. 545). Surrounding the cells of the epithelium there is a layer of collagen and a system of smooth circular muscle fibers.

The crystalline style projects obliquely upwards and its tip is placed in the aperture of the dorsal hood.

The left pouch is on the left wall of the stomach. The upper border of the left pouch is penetrated by a lobe

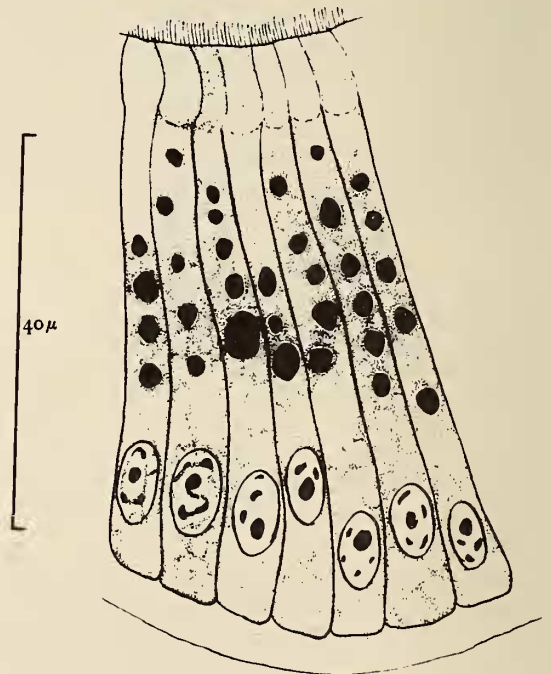


Figure 8

Epithelium of the stomach showing spherical granules

of the gastric shield. The left pouch receives one duct from the digestive diverticula on the left side of the body.

In the grooves of the sorting area the cilia beat towards the intestinal groove, while the cilia on the tops of the ridges beat towards the dorsal hood as in *Galeomma glycymeris* (REID, 1965, p. 169).

A circulating current is set up by the cilia on the top of the sorting area. It is this general circulation which

carries large particles and masses of particles towards the dorsal hood and gastric shield. Light particles are carried in the current flowing across the ridges of the sorting area into the dorsal hood. Heavy particles are driven against the surface of the sorting area and fall into the transverse rejection grooves. Small and heavy particles are carried away to the intestinal groove and then into the mid-gut.

The sorting area in *Pseudopythina rugifera* is composed of large ridges and wide grooves. The cilia on the crests of the folds beat, carrying particles to the left region of the stomach. As in *Scintilla hanleyi* (PURCHON, 1958, p. 499) there is no sorting area within the dorsal hood, nor is there one on the right wall of the stomach.

From the oesophagus a narrow ciliated ridge (r_1) passes backwards from the left corner of the oesophageal orifice to the dorsal hood. The dorsal hood receives particles from the anterior part of the stomach by means of that ridge. A similar ridge was described by PURCHON (1958, p. 499) in *Scintilla hanleyi*.

The sorting area is small; large particles are not rejected and excessive quantities of small particles are accepted (PURCHON 1958, p. 487).

EXCRETORY SYSTEM

The kidney (Figures 9 C, 9 K) is composed of a pair of elongated sacs with glandular walls which intercommunicate in the median part, ventral to the pericardial cavity. Each kidney sac is lobed ventrally and dorsally and there are no internal folds of the wall to produce spongy kidney. It opens directly at its anterior end to the supra-branchial chamber by the external renal aperture, which has ciliated cells. These ducts (rpd) are long and they run posteriorly from the pericardial cavity and open into the posterior part of the kidney. Histologically this system is very similar to that of *Kellia* and *Montacuta* (OLDFIELD, 1961, p. 276).

NERVOUS SYSTEM

There are three pairs of ganglia: the cerebral, pedal, and visceral. The cerebral ganglia lie behind the anterior adductor muscle, one on each side of the oesophagus, and joined together by a supra-oesophageal commissure. The buccal nerve, the anterior adductor nerve, and the anterior retractor pedis muscle nerve arise from these ganglia.

The pedal ganglia are so close together that they appear as one, lying in the mid-line ventrally to the digestive

diverticula. Each pedal ganglion gives rise to the anterior pedis nerve, the lateral pedis nerve, and the byssus nerve.

The visceral ganglia lie on the anterior surface of the posterior adductor muscle, and have the branchial nerve, the posterior adductor nerve, and a posterior pallial nerve.

The cerebro-visceral connective and the cerebro-pedal connective are similar to those described by OLDFIELD (1961, p. 280) for the genera *Kellia* and *Montacuta*.

REPRODUCTIVE SYSTEM

The specimens examined were females. The gonad is a large hollow organ with two anterior lobes, each subdivided into many lobules and communicating with a single, median posterior chamber. As in *Kellia suborbicularis* (OLDFIELD, 1961, p. 281), the posterior chamber opens on each side of the body by a short ciliated duct into the supra-branchial chamber of the inner demibranch. The external genital opening is immediately anterior to the exterior renal opening.

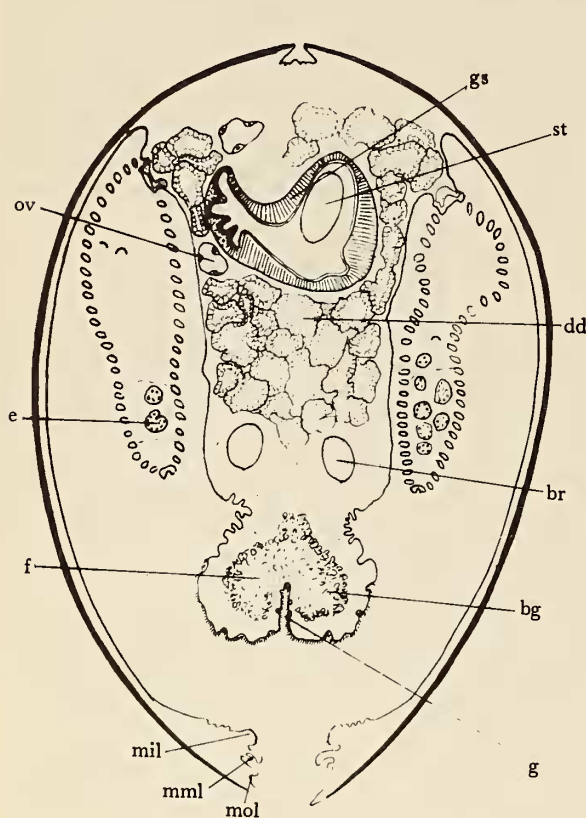
As in *Kellia suborbicularis* (LEBOUR, 1938, p. 447) and other specialized eulamellibranchs (OLDFIELD, 1964, p. 79) fertilization occurs probably within the gills, the spermatozoa of another individual being drawn in with the inhalant current.

The specimens collected in April contained developing embryos (e) within the gills, and the gonad appeared empty with a few small atretic ova. *Pseudopythina rugifera* is not a common animal in Tomales Bay and further investigations may reveal male or hermaphrodite forms. More extensive collecting of animals would reveal if the species is a protogynous consecutive hermaphrodite in which there is no overlapping of male and female phases, as in *Kellia suborbicularis* and *Montacuta ferruginosa* (OLDFIELD, 1961, p. 289).

DISCUSSION

Pseudopythina rugifera is adapted to live attached and is found fixed by its byssus to the ventral surface of *Aphrodita* or *Upogebia*. The species attaches and detaches itself at will, as observed by MACGINITIE and cited by QUAYLE (1960, p. 74). The animal has a well developed foot and a wide pedal gape to allow the foot to be extruded. It has two pallial apertures, a large antero-ventral and a small posterior one.

Concerning the ciliary mechanism of the ctenidia the species is similar to *Kellia suborbicularis* (OLDFIELD, 1961, p. 264) as both have guarding cilia in both sides of the food groove on the inner ctenidia. This suggests that the



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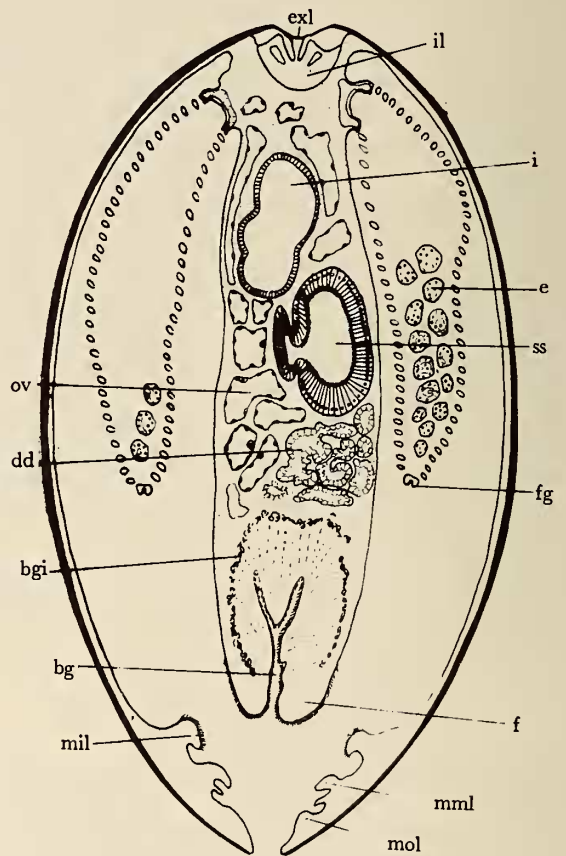


Figure 9

Pseudopythina rugifera (CARPENTER, 1864)

Diagrammatic transverse sections through the animal (× 72)

A — at level of the stomach B — at level of the style sac
C — at level of the kidneys

- bg — byssus cavity bgi — main byssus gland
- br — byssus retractor muscle dd — digestive diverticula
- e — embryos exl — external ligament fg — food groove
- g — foot groove gs — gastric shield i — intestine
- id — descending lamella of inner demibranch il — internal ligament
- k — kidney mil — inner fold of mantle edge
- mml — middle fold of mantle edge od — outer demibranch
- mol — outer fold of mantle edge ov — ovary
- prp — posterior retractor pedis muscle r — rectum
- rpd — reno-pericardial duct ss — style sac st — style

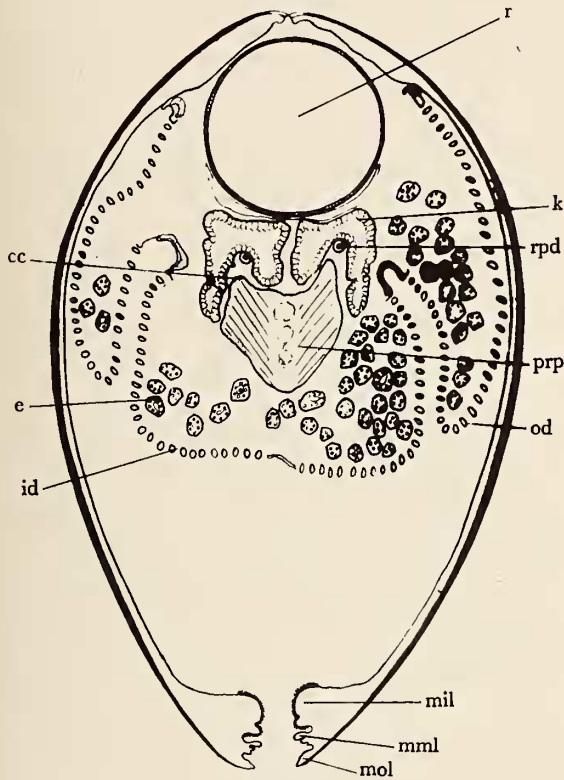
animal lives in a silt or muddy substrate. The manner in which the rejected material is violently shot out of the pallial cavity by a sudden contraction of the adductors proves that the animal lives in a sandy or muddy environment (OLDFIELD, *loc. cit.*).

The byssus apparatus is well developed with a large byssus retractor muscle as in *Montacuta substriata* which lives attached to the spines of the sea urchins. The byssus apparatus is divided in the middle by a fold into two longitudinal parts. Each part is divided into 10 to 12 slitlike compartments and is similar to *Potidoma subtrigonum* (JEFFREYS) described by DEROUX (1961, p. 119). It is different from the other species belonging to the genera *Kellia*, *Montacuta*, and *Lasaea*.

The absence of a well developed sorting area in the stomach suggests that excessive quantities of small particles or large particles are not rejected.

The rectum is very wide. The contents of the intestine

when compared with those of the stomach show a larger number of more or less complete but empty diatom tests and protozoan skeletons. This suggests that while some



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mechanical trituration occurs in the stomach, enzymes are also present (OWEN, 1956, p. 559).

The stomach of *Pseudopythina rugifera* is in some aspects similar to that of *Scintilla hanleyi*, as both have two ciliated ridges from the anterior left face of the stomach to the dorsal hood. The oesophagus, the left pouch and the dorsal hood are similar in both species. While in *P. rugifera* the style sac and the intestine intercommunicate by an opening, this is not found in *S. hanleyi*. The style sac and intestine join in a short extension and the intestine leaves the style sac laterally on the right side.

The sorting area in *Pseudopythina rugifera* starts in the right wall of the stomach, passes upwards from the region of the intestinal groove towards the oesophageal aperture to the left wall of the stomach and then surrounds the left pouch, ending close to the major typhlosole. *Scintilla*

hanleyi has two sorting areas (PURCHON, 1958, p. 498): S_1 on the anterior face of the stomach which passes from the intestinal groove to the oesophageal aperture, and S_2 , the second sorting area, on the floor of the left pouch. It seems that *P. rugifera* has a stomach more primitive than *S. hanleyi*, as the two sorting areas are joined into only one in the present species.

The stomach of *Pseudopythina rugifera* is an example of simplification of structure: the major typhlosole is reduced. The sorting area directs particles toward the intestinal groove.

The stomach of *Pseudopythina rugifera* probably triturates ingested particles by muscular action and the relatively large size of the stomach and style sac is an adaptation for the ingestion of large quantities of bottom material (OWEN, 1956, p. 562).

SUMMARY

Pseudopythina rugifera (CARPENTER, 1864) lives attached to the ventral surface of the polychaete worm *Aphrodita* and to the anomuran crustacean *Upogebia*. It occurs on the Pacific Coast of North America, from Alaska to Lower California. The shell is small, oval-oblong, and fragile, reflecting the protected habitat of the species. There are only two pallial apertures, a large anterior and ventrally located one which is a common inhalant and pedal opening, and a small exhalant aperture. The siphons do not protrude beyond the shell.

The ctenidia are similar to those of *Kellia suborbicularis* and both outer and inner demibranch on each side are fused ventrally.

The byssus apparatus is well developed and is very similar to that of *Potidoma subtrigona* (DEROUX, 1961, p. 119).

The anatomy of the stomach is described in detail, and the stomach belongs to Type 4 (PURCHON, 1958, p. 488).

Specimens collected in April contained developing embryos within the gills. Future research will prove if *Pseudopythina rugifera* is a protogynous consecutive hermaphrodite in which there is no overlapping of male and female phases as in *Kellia suborbicularis* and *Montacuta ferruginosa*.

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